Potomac Heritage

National Park Service
U.S. Department of the Interior

National Scenic Trail
District of Columbia//Maryland/
Pennsylvania/Virginia

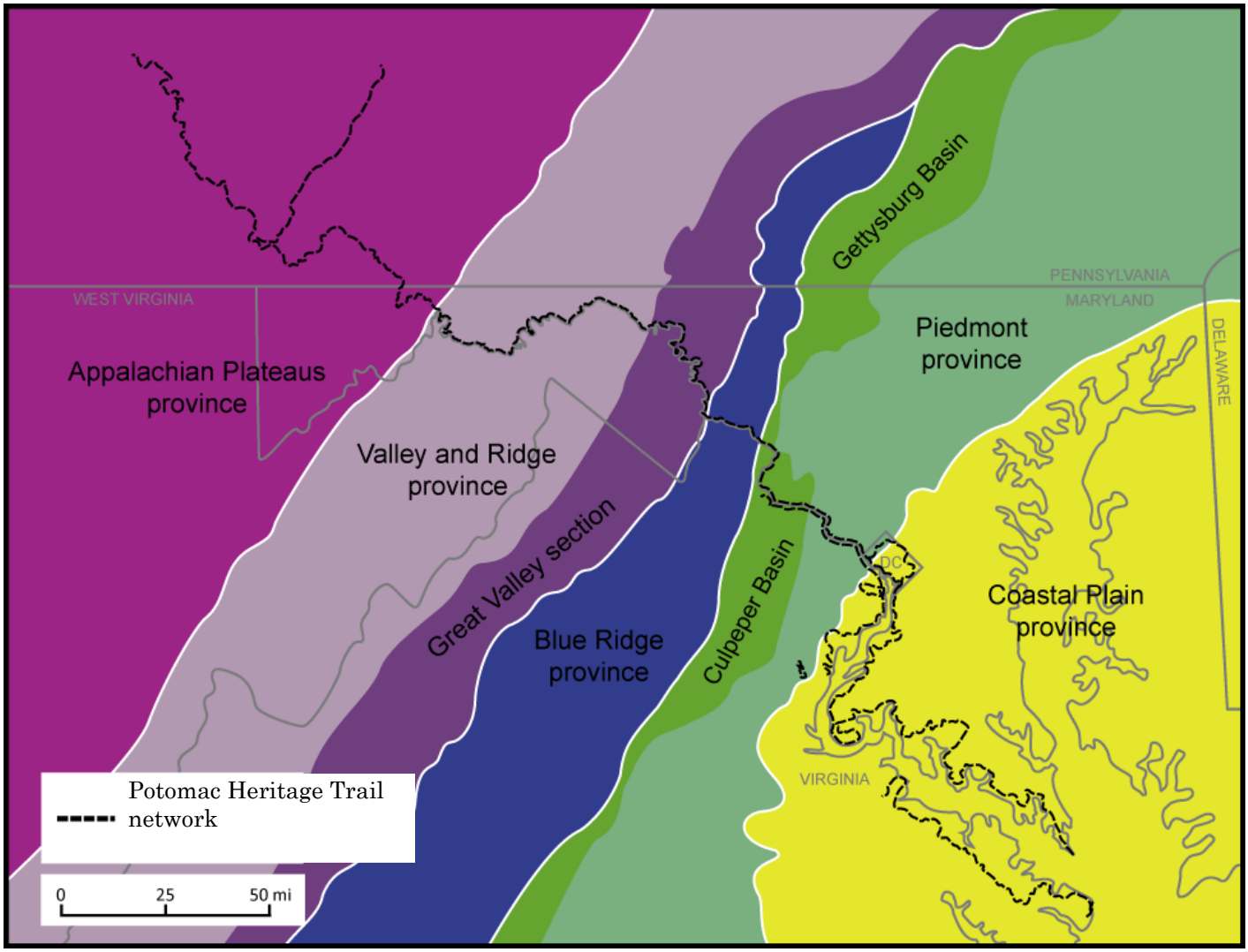

Figure 1. Physiographic provinces of the Mid-Atlantic region and the Potomac Heritage National Scenic Trail network.

As you travel the Potomac Heritage National Scenic Trail corridor, you will notice that the topography and geology differs greatly depending your location: These differences are due to the characteristics of distinctive physiographic provinces—geographic regions distinguished by geology, topography, and climate. The Trail network winds through five such provinces—the Coastal Plain, Piedmont, Blue Ridge, Valley and Ridge, and Appalachian Plateaus (Figure 1)—and each represents a different episode in the geologic history of eastern North America. Compared with other national scenic trails in the National Trails System, the Potomac Heritage Trail corridor is unique for a range of landscape types.

Blue Ridge

The Blue Ridge province (Figure 1), bounded on the east by Catoctin Mountain and on the west by Blue Ridge and Elk Ridge, contains the oldest rock units in the region, formed 1.1 billion years ago as continents merged to create the supercontinent called Rodinia (Figure 2), which preceded the more famous Pangea. These continental collisions created high mountain chains that have since eroded; the only evidence of them today is the Blue Ridge Basement Complex, the metamorphic and igneous cores exposed in the Blue Ridge province. These rocks also underlie most of the Appalachian region, though they are not exposed in other physiographic provinces.

Blue Ridge (continued)

As Rodinia broke apart between 700 and 550 million years ago, magma erupted onto the land surface, cooling to form basalt; these flows were metamorphosed later by tectonic activity. This metabasalt, named for Catoctin Mountain where it is exposed, is called the Catoctin Formation. This continental rifting produced the proto-Atlantic Ocean, so named because it preceded the Atlantic Ocean and occupied roughly the same place relative to current geography.

As the proto-Atlantic widened, the land surface changed: Many streams and deltas drained from the Rodinian mountains into the emerging ocean; these deposits are represented by the Weverton and Harpers Formations, best seen near Harper's Ferry, West Virginia, and at Maryland Heights on the Potomac River. By the beginning of the Cambrian, extensive beach sand deposits of the Antietam Formation covered the region. These beach deposits represent the onset of rising sea levels that would drastically change the regional environment yet again. The evidence of sea level advance can be seen in the Hagerstown and Frederick Valleys.

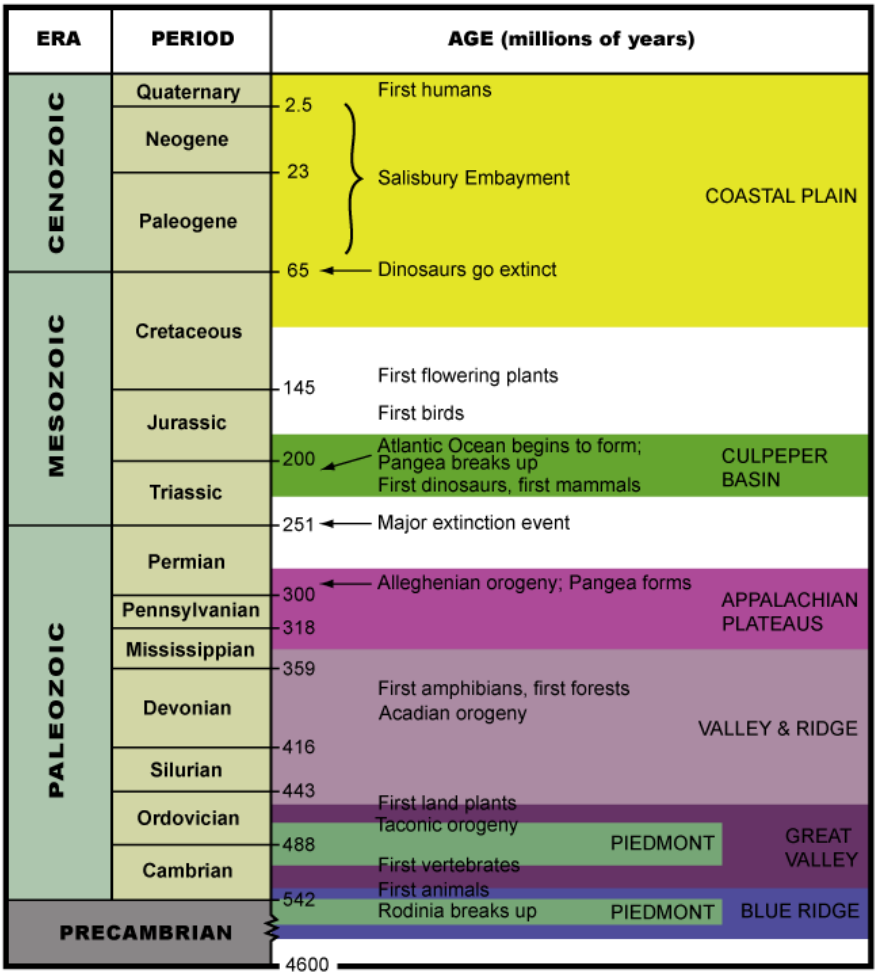

Figure 2. Timescale highlighting the past 542 million years and showing significant geologic and evolutionary events. Colors and physiographic provinces refer to Figure 1.

Valley and Ridge

The Valley and Ridge province lies between the Allegheny Front in the west and Blue Ridge in the east. The Great Valley section (Figure 1) is the wide valley between the Blue Ridge and North Mountain. The rocks of the Great Valley (called Cumberland Valley in Pennsylvania, Hagerstown Valley in Maryland, and Shenandoah Valley in Virginia) were deposited on a broad, shallow off-shore platform that sloped eastward to the proto-Atlantic Ocean formed following the breakup of Rodinia.

This shallow sea existed during the Cambrian and Ordovician (Figure 2) periods. The Great Valley is almost entirely limestone, making it fertile farmland. These limestone units can be seen along the Chesapeake & Ohio Canal Towpath in Washington County, Maryland. The widespread deposition of limestone stopped in the Late Ordovician at the onset of the Taconic orogeny (Figure 2), the first mountain-building event to affect the east coast since the formation of Rodinia. The Taconic orogeny was the result of a Japan-like island chain accreting onto the eastern margin of North America, adding new terrain in the east and changing the locus of deposition from the coast to a shallow sea over present-day West Virginia.

Through the Silurian and Devonian, the small continental sea over West Virginia advanced and receded several times while, in the east, the Taconic mountains eroded. West of the Great Valley, alternating marine and terrestrial sedimentary rock units are the result of such changes and form the numerous valleys and ridges for which the province is named. The ridges are comprised of tough, weather-resistant sandstone layers, and the valleys of easily-weathered shale. These rock units represent nearshore marine and terrestrial environments of the Late Ordovician, Silurian, and Devonian.

In the Late Devonian (Figure 2), another orogeny occurred as another island chain accreted onto North America. The Acadian orogeny, as it is known, added yet more landmass to the eastern margin of the continent.

Appalachian Plateaus

The Great Allegheny Passage and Laurel Highlands Hiking Trail pass through the Appalachian Plateaus physiographic province. This province includes the highest and most mountainous parts of the Appalachians and begins with the Allegheny Front west of Cumberland, Maryland. The Great Allegheny Passage crosses the Eastern Continental Divide, marking the division between rivers that drain to the Atlantic Ocean and those that drain to the Mississippi River.

The rock units of this province were deposited from the Late Devonian through the Early Permian (Figure 2) and comprised of interbedded sandstone, shale, and limestone representing low-lying floodplain and shallow marine environments. The extensive coal beds of western Pennsylvania, West Virginia, and Ohio were deposited at this time, indicative of the warm, moist forests that formerly covered the region.

In the Late Permian, the last of the major East Coast orogenies began as the African and South American continents collided with North America. This was the Alleghenian orogeny (Figure 2) that produced Pangea, the most recent supercontinent. The force of the collision was so great that it produced the many examples of folded and faulted strata evident in the Appalachian Plateaus province and throughout the Appalachian region. Virtually every rock unit exposed in the region was affected by this collision, a fact that you can see as you travel the Great Allegheny Passage and Laurel Highlands Hiking Trail in Pennsylvania, and portions of the Chesapeake & Ohio Canal Towpath in western Maryland. The mountains that resulted from this continental collision probably rivaled the height of the Himalayas today.

Piedmont

The Piedmont province (Figure 1) comprises several sections with very different geologic histories. The Potomac Terrane is the eastern-most part of the Piedmont between Rock Creek and the area near Seneca, Maryland. The rocks of this section were originally deposited in the Late Precambrian to Early Cambrian as the supercontinent Rodinia broke apart (Figure 2). Sediment deposited into emerging ocean trenches was metamorphosed during the Taconic, Acadian, and Alleghenian orogenies, and igneous dikes intruded into this Terrane during these periods of tectonic activity. The Mather Gorge and Sykesville Formations can be seen cropping out along the Potomac River from the Potomac Heritage Trail in Fairfax and Arlington Counties in Virginia, and eastern portions of the Chesapeake & Ohio Canal Towpath in Maryland and Washington, D.C. The western end of the Fort Circle Parks Trail in Washington, D.C., also travels through this part of the Piedmont province (Figure 1).

The Culpeper Basin (Figure 1) stretches from Seneca, Maryland, to the foot of Catoctin Mountain. It is one of several Mesozoic rift basins that formed as Pangea began to rift apart beginning in the Late Triassic (Figure 2). In the Culpeper Basin, layers of sandstone, siltstone, conglomerate, and limestone deposited in floodplain streams and lakes are intruded by igneous dikes and sills of Early Jurassic age. These dikes fed lava flows represented today by basalt deposits in the Culpeper and other Late Triassic basins along the east coast. The sandstone of the Manassas Formation is characterized by its red color and was quarried for local buildings; you can see this “Seneca red sandstone” in the Smithsonian Castle in Washington, D.C. The Potomac Heritage Trail in Loudoun County, Virginia, and the Chesapeake & Ohio Canal Towpath in Montgomery County, Maryland, travel through the Culpeper Basin.

The Westminster Terrane occurs in the vicinity of the Monocacy River in Maryland, but it is not exposed in Virginia. It represents sediment that was deposited into the proto-Atlantic Ocean trenches in the Late Precambrian and Early Cambrian; these deposits were metamorphosed along fault lines, resulting in limited exposure in this region.

The Frederick Valley section of the Piedmont province is very similar to the Great Valley section of the Valley and Ridge province. The limestone units of the Frederick Valley were deposited contemporaneously with those of the Great Valley on a shallow offshore platform. Although the formations of these two valleys are now separated due to regional folding and faulting, they represent a continuous section of shallow off-shore environments that existed during the Cambrian and Ordovician.

Coastal Plain

The Coastal Plain province includes everything east of the Piedmont (Figure 1). As Pangea rifted apart, the Appalachian Mountains eroded and the Atlantic Ocean basin widened forming in roughly the same location as today. Sandy coastal sediments began to be deposited in the Early Cretaceous over older Proterozoic rocks that now underlie the Coastal Plain. Localized embayments existed all along the Atlantic coast, and an embayment centered on Delaware, Maryland, and Virginia persisted from this time through the early Pleistocene. The Salisbury Embayment advanced and retreated several times during the late Mesozoic and Tertiary (Figure 2). Thick sequences of mostly sandy, shelly marine deposits accumulated in eastern Maryland and Virginia.

These various units have been well studied by geologists and paleontologists since the late nineteenth century, and many of these formations are named for regional geographic features. The Miocene-aged Calvert Formation, exposed at the Calvert Cliffs along the Chesapeake Bay, is perhaps the best known of these units and is famous for its fossil collecting localities. The Potomac Heritage Trail in Prince William Forest Park and eastern Fairfax County; the Alexandria Heritage Trail, Mount Vernon Trail, and Northern Neck Heritage Trail in Virginia; the Fort Circle Parks Trail in Washington, D.C.; and the Southern Maryland Potomac Heritage Trail On-Road Bicycling Route are all located in the Coastal Plain province.

The Potomac River

The Potomac River unites all these physiographic provinces and is part of the reason we recognize them today. The Potomac and other rivers of the region were established by about 3.5 million years ago. During the last Ice Age, which began about 1.5 million years ago, sea levels fluctuated as ice sheets advanced and retreated over North America. Regional uplift of the Earth's crust and fluctuations in sea level caused the Potomac and other rivers to incise their courses, cutting down through mountain ridges: In essence, the modern topography of the region began to take shape.

Mather Gorge and Great Falls formed in the last 30 thousand years as sea level fell during the last ice age. These features can be seen from the Chesapeake & Ohio Canal Towpath in Maryland and from Great Falls Park in Virginia.

- Research and paper by Katharine Loughney, Geo-Scientist in the Park, 2012